US005535435A

United States Patent [19]

Balzano et al.

[11] **Patent Number: 5,535,435**

[45] **Date of Patent: Jul. 9, 1996**

[54] **COMMUNICATION DEVICE USING ANTENNA HAVING AN OFFSET**

[75] Inventors: **Quirino Balzano**; **Scott H. Richards**, both of Plantation; **Bruce A. Claxton**, Coral Springs, all of Fla.

[73] Assignee: **Motorola, Inc.**, Schaumburg, Ill.

[21] Appl. No.: **272,472**

[22] Filed: **Jul. 11, 1994**

[51] **Int. Cl.**[6] **H04B 1/38**

[52] **U.S. Cl.** **455/89**; 455/90; 455/129; 343/702

[58] **Field of Search** 455/89, 90, 129; 343/702; 379/58, 59, 61

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,138,681	2/1979	Davidson et al.	343/702
5,337,061	8/1994	Pye et al.	455/89 X

FOREIGN PATENT DOCUMENTS

0508299	4/1992	European Pat. Off. .
2702324	9/1994	France .
4-127723	4/1992	Japan .

Primary Examiner—Chi H. Pham
Attorney, Agent, or Firm—M. Mansour Ghomeshi

[57] **ABSTRACT**

A radio communication device (**100**) includes an offset antenna (**104**) and a housing (**101**). The offset antenna (**104**) includes an offset portion (**108**) and radiating portion (**116**). The antenna (**104**) is coupled to the radio housing (**101**) through a pivot mechanism (**106**) so that the antenna could rotate from a stowed position (**114**) to a deployed position (**112**). In the deploy position (**112**), the antenna is away from the user, a distance equal to the sum of the width (**110**) and the offset portion (**108**). This separation of the antenna from the body provides for significant improvement in the antenna performance.

18 Claims, 3 Drawing Sheets

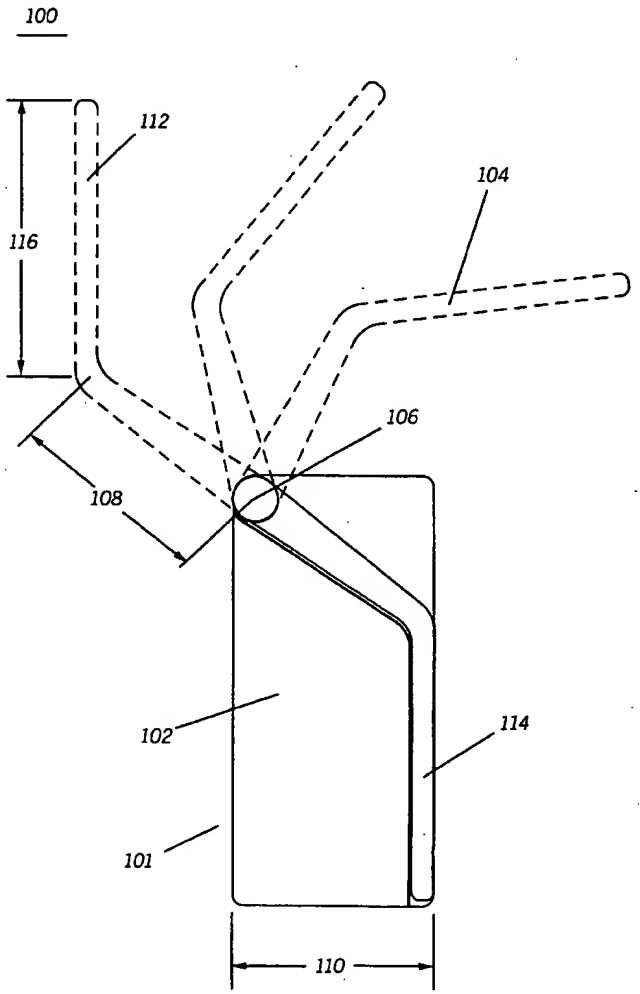


FIG. 1

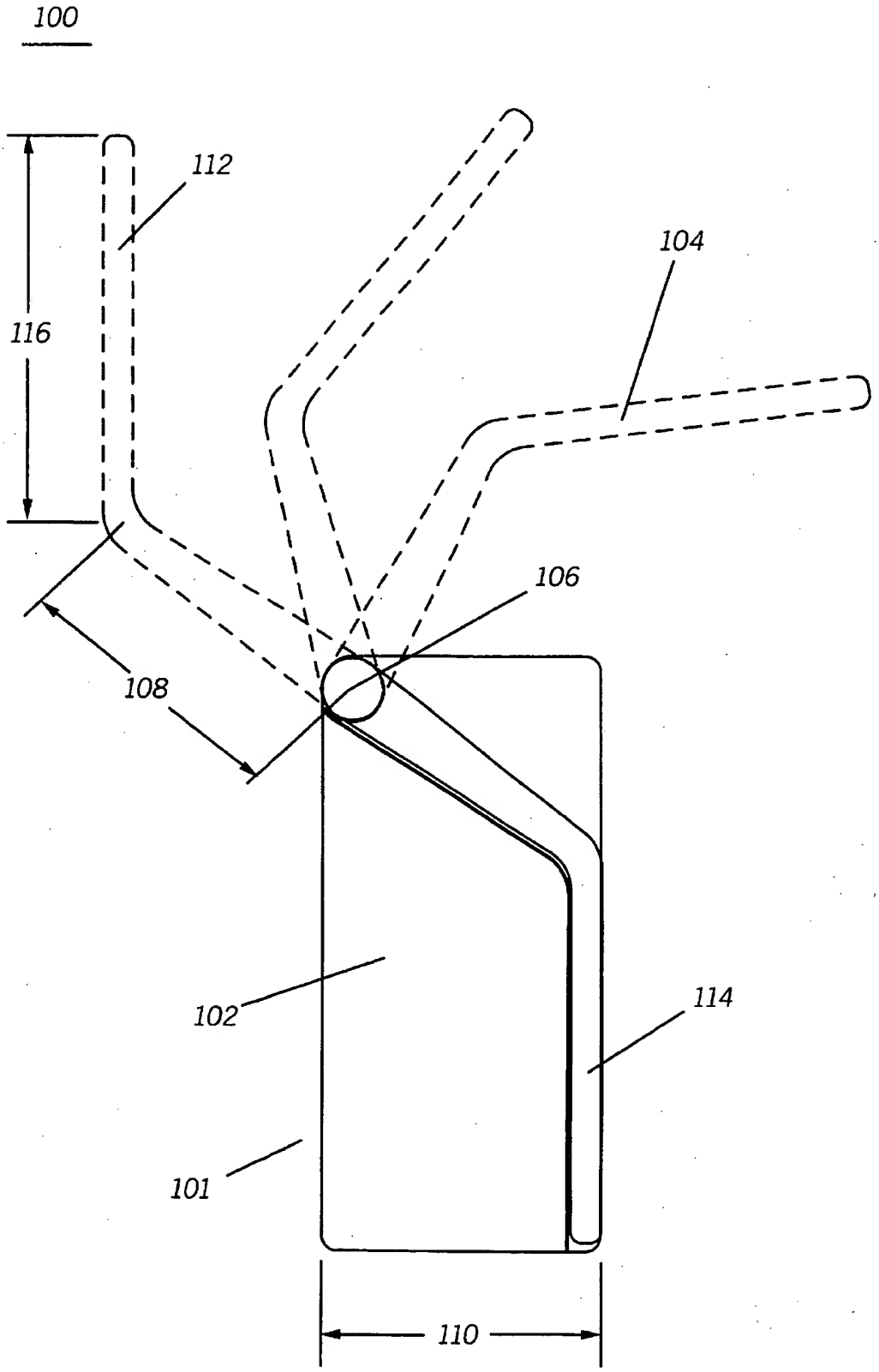


FIG.2

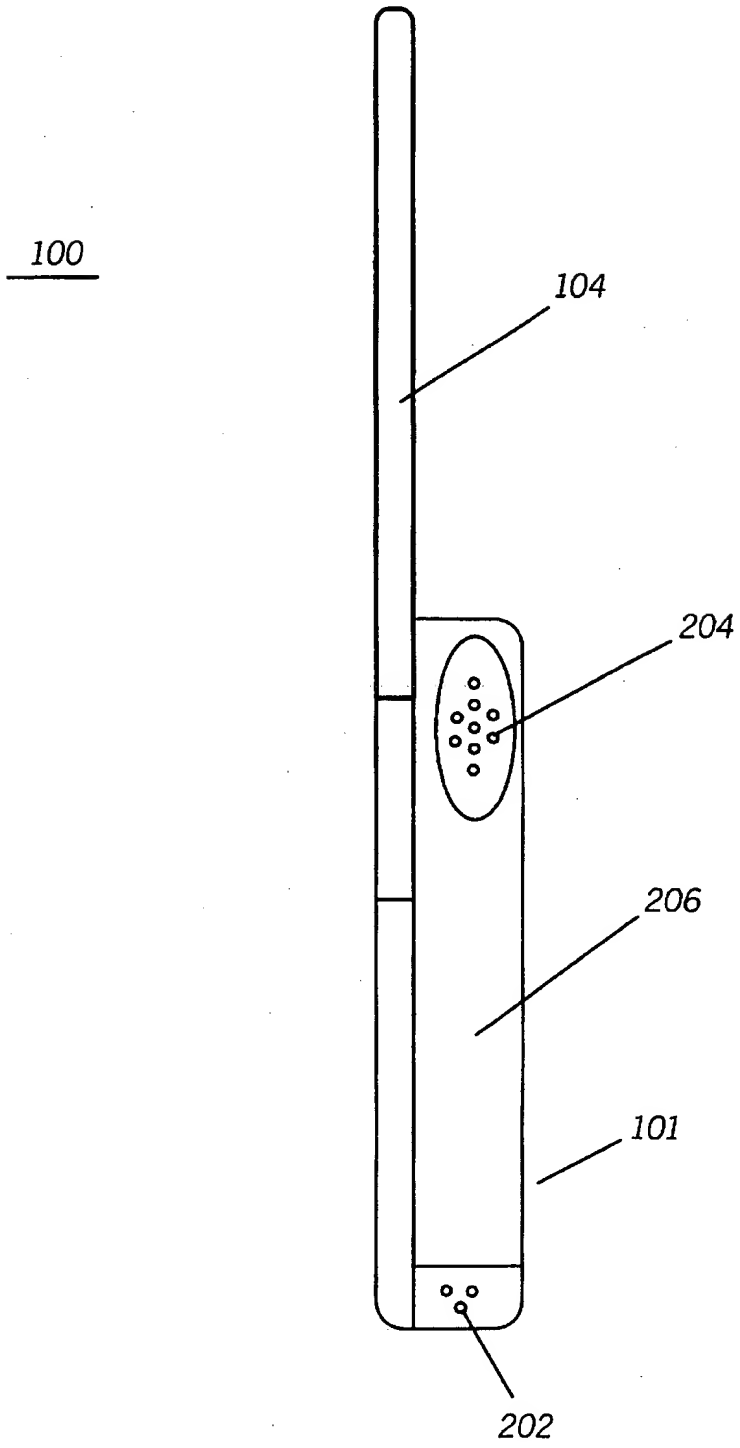


FIG.4

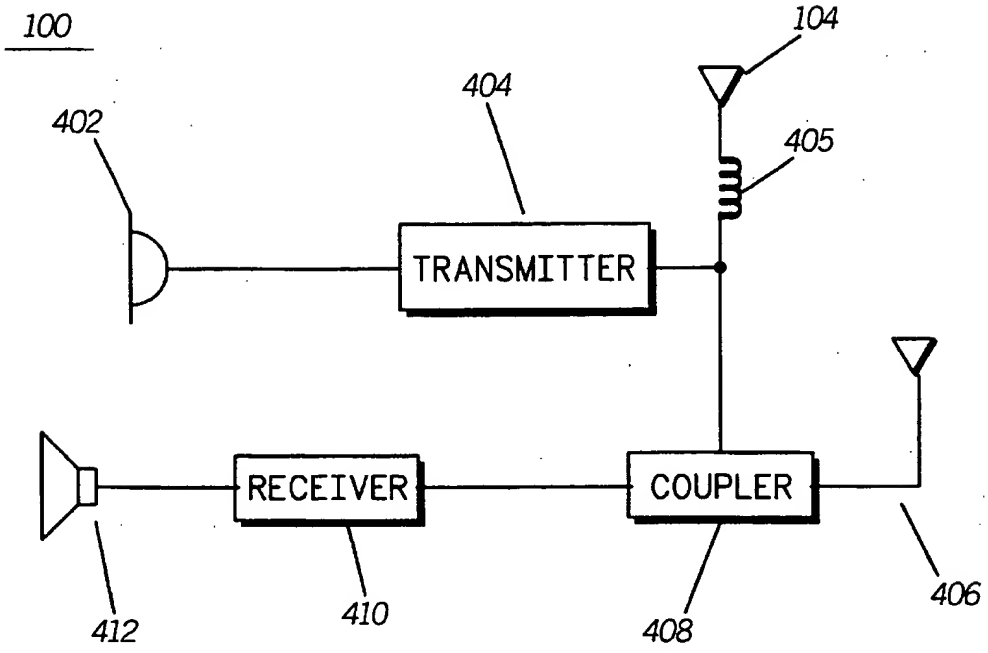
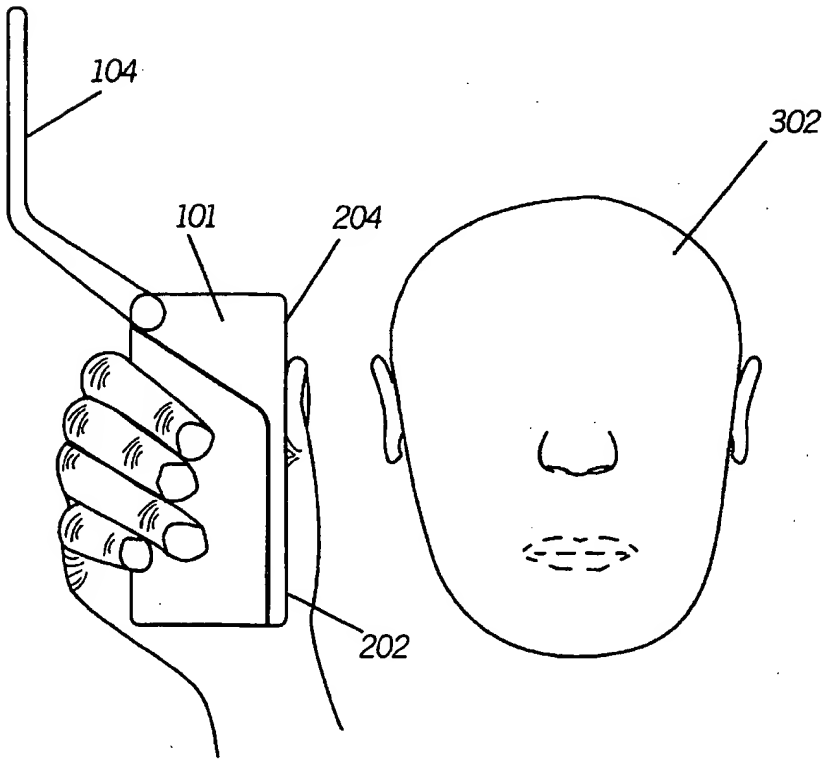

100
104
404
402
405
TRANSMITTER
RECEIVER
COUPLER
412
410
408
406

FIG.3


104
302
101
204
202

COMMUNICATION DEVICE USING ANTENNA HAVING AN OFFSET

TECHNICAL FIELD

This invention is generally related to antennas and more particularly to antennas used with portable communication devices.

BACKGROUND

Portable communication devices, such as cellular telephones generally use a vertically mounted antenna for the transmission and reception of radio frequency signals. Several types of antennas, such as half-wave and quarter-wave are presently used with such devices. A problem with present antennas is the capacitive and inductive coupling to the body of the user. This body coupling degrades the performance of the antenna, and ultimately the communication device, due to reflection, diffraction and dissipation by the Joule effect of the RF (Radio Frequency) energy by the body of the user. A very common antenna is the quarter-wave whip and physically shorter quarter-wave antenna which is popular due to its size. The radiation patterns of quarter-wave antennas tend to have a deep null behind the head of the person holding the radio. The closer the radio is held to the body the deeper this null. Since some radio applications demand that the user hold the radio to their ear, e.g. cellular phones, the designer is forced to compromise the performance of the radio in order to achieve the device's intended use.

It is desired to have an antenna that overcomes the performance problems of the prior art without sacrificing the convenience of use.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a radio communication device **100** in accordance with the present invention.

FIG. **2** shows a side view of the radio of FIG. **1**.

FIG. **3** shows a communication device in accordance with the present invention.

FIG. **4** shows the holding position of the radio **100**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, a radio communication device **100** in accordance with the present invention is shown. The radio **100** is used for the transmission and reception of radio frequency signals. An offset antenna **104** provides the means for receiving and transmitting the signals. The radio **100** includes a housing **101** that accommodates the circuitry of the transmitter and the receiver. The housing **101** includes two major surfaces. One major surface **102** includes a width **110** and is used by the antenna **104** as a resting area. The other surface **206** will be described in association with FIG. **2**. The antenna **104** includes a deployed or active position as shown by **112** and a stowed or inactive position as shown by **114**. The coupling between the antenna and the housing is accomplished via a pivot mechanism **106** that allows the antenna **104** to rotate a distance, namely 180 degrees between its fully deployed position **112** and its resting position **114**. The surface **102** may be contoured to integrate the antenna **104** into the overall form of the radio **100** in its stowed position.

In general, the antenna **104** includes first and second ends connected to each other via a radiating portion **116** and an offset portion **108**. It is at the second end that the offset portion **108** is coupled to the radio via the attachment means **106**. In the transmit mode, the antenna **104** is rotated out of its resting (stowed) position **114** to its fully deployed position **112**. In so doing, the antenna will be away from the first major surface **206** (FIG. **2**) by a distance equal to the sum of the offset portion **108** and the width of the radio **110**. It is noted that the location of the attachment point **106** where the radio housing **101** is attached to the antenna **104** is critical in order to result in a maximum offset. As depicted in FIG. **1**, this attachment point **106** is located in a corner of the surface **102** which is furthest away from the surface **206** (FIG. **2**). This location is critical as the distance between the first surface **206** and the attachment point **106** is added to the length of the offset portion **108**. In other words, the location of the attachment point **106** is chosen to result in the maximum offset between the radiating portion **116** and the surface **206** when the antenna is deployed.

In the preferred embodiment, the radiating portion **116** is a vertical section that is longer than the offset portion **108**. The offset antenna **104** may take one of many several shapes, such as a dogleg shape, an L shape, a curved or a tapered antenna. Indeed, any antenna with a bent portion that could function as an offset may be suitable. The objective is to afford the radiating portion **116** a distance away from the surface **206**, hence the user, in order to improve antenna performance. The kind of radiator used for **116** may be any of the sleeve dipole antennas or any antenna known in the art, such as end-fed, e.g. end-fed half-wave dipoles. It is noted that the offset portion **108** could include a choke **405** to prevent radio frequency currents from returning to the radio communication device from the radiating portion **116** These currents are unwanted because they are dissipated in the hand and the face of the user thus increasing the net RF power loss.

To increase the offset **108**, several schemes including telescopic features may be employed. A telescopic assembly at the junction of the offset section **108** and the radiating section **104** would allow the user to manually improve the performance of the antenna. In addition, the radiating portion **104** may include a telescopic feature for improved radiation.

Referring to FIG. **2**, a side view of the radio communication device **100** in accordance with the present invention is shown. This view reveals some details about the first surface **206**. A microphone opening **202** is located in the lower section complemented by a speaker opening **204** on the top. Similar to a cellular telephone or a two way portable device the microphone opening **202** and the speaker opening **204** are appropriately located next to the position of the mouth and the ear, respectively, of the user. In such a fashion, the antenna radiating portion **116** will be away from the user by a distance equal to the width **110** and offset **108** so as to minimize pattern distortion and radiation loss from the body presence. In addition, this offsets minimizes the null that is created behind the user when quarter-wave or short antennas are used.

This feature is better visualized by referring to FIG. **3**, where the position of the radio **100** in association with the user is illustrated. As can be seen from this figure, the antenna **104** is away from the body as illustrated by **302** in order to minimize the effect of body capacitance on the radiation of the antenna **104**.

The reduction in the interference from the body capacitance results in a more efficient transmitter. In the preferred

embodiment, the antenna **104** is chosen to perform optimally in the transmit mode. This helps designers in minimizing nulls and the effects of body RF dissipation in the mode with greatest power consumption. To accommodate for the reception of signals, a second antenna may be used that may function either independent of or along with the antenna **104**. In the latter, the second antenna must be so designed to operate with the antenna **104** both in the stowed position and the deployed position.

Referring to FIG. **4**, a block diagram of a communication device is shown. The transmitter **404** is used for the transmission of signals received through a microphone **402**. A receiver **410** couples received signals to a speaker **412**. The microphone **402** is located behind the microphone opening **202** while the speaker **412** is located behind the speaker opening **204**. The antenna **104** is coupled to the transmitter **404** directly and to the receiver **410** through a coupler **408**. This coupler **408** provides for the coupling of a second antenna **406** to the receiver **410**. The antenna **406** is a receiver optimum antenna that in conjunction with the antenna **104** provides for an optimum reception of radio frequency signals if necessary, when the radio is located against the body with the antenna folded. It is noted that although a second antenna may be used for optimum performance in the receive mode, it is feasible to design the antenna **104** to provide sufficient reception when in the stowed position **114** or the deployed position **112**. In such a fashion, the need for the second antenna **406** is eliminated.

In summary, a radio communication device having an offset antenna has been disclosed. The antenna includes an offset portion and a radiating portion and is coupled to the radio through a pivot that provides for its rotation from its stowed position to a fully deployed position. When in the deployed position, the antenna is away from the user by a distance equal to twice the width of the radio. This separation between the user and the antenna provides for improved performance of the antenna.

What is claimed is:

1. A radio communication device having a transmit mode and a receive mode of operation, comprising:

a housing having a first major surface, a second surface, a width, and a microphone located on the first major surface;

a transmitter substantially situated within the housing;

an antenna having a deployed position and a second position and being pivotally coupled to the housing and comprising:

a radiating portion;

an offset portion coupled to the radiating portion; and

attachment means for pivotally attaching the offset portion of the antenna to the housing so that the radiating portion is away from the housing in a plane parallel to the first major surface a distance substantially equal to the length of the offset portion when in the deployed position and resting on the second surface of the housing when in the second position.

2. The radio communication device of claim **1**, wherein radiating portion includes a vertical section longer than the offset portion.

3. The radio communication device of claim **1**, wherein the offset portion includes a length equal to the width of the housing.

4. The radio communication device of claim **1**, wherein the antenna includes a dog leg shaped antenna.

5. The radio communication device of claim **1**, wherein the antenna includes a sleeve dipole antenna.

6. The radio communication device of claim **1**, wherein the antenna includes an end-fed antenna.

7. The radio communication device of claim **1**, further including a second antenna for providing the radio communication device with optimum performance in the receive mode.

8. The radio communication device of claim **7**, wherein the first antenna includes means for providing the radio communication device with optimum performance in the receive mode when the first antenna is in the second position.

9. A radio communication device, comprising:

a housing having first and second major surfaces;

a transmitter substantially situated within the housing;

a receiver substantially situated within the housing;

a microphone opening located on the first major surface;

a first antenna having an active position and an inactive position, the first antenna comprising:

an antenna body having an offset section with a length;

attachment means for pivotally attaching the offset section of the first antenna to the housing whereby the first antenna is away from the first major surface in a plane parallel to the same at least a distance equal to the length of the offset section when it is in the active position in order to improve the radio frequency (RF) performance of the first antenna and rests on the second major surface when in the inactive position; and

a second antenna for providing the receiver with reception of a radio frequency signal when the first antenna is in the second position.

10. The radio communication device of claim **9**, wherein the first antenna includes an L shape antenna.

11. The radio communication device of claim **9**, wherein the first antenna includes a dog leg shaped antenna.

12. The radio communication device of claim **9**, wherein the first antenna includes a tapered antenna.

13. The radio communication device of claim **9**, wherein the first antenna includes a transmit optimum antenna.

14. The radio communication device of claim **9**, wherein the offset section of the first antenna includes a chokc to prevent RF from returning to the radio communication device.

15. A radio communication device, comprising:

a transmitter for generating a transmit signal;

a housing for accommodating the transmitter, the housing having first and second major surfaces;

a microphone opening located on the first major surface;

a rotatable antenna coupled to the transmitter, the antenna having a deployed position away from the first major surface in a plane parallel to the same for providing the radio with optimum transmission of the transmit signal and a stowed position on the second major surface, the antenna comprising:

an L shaped body;

attachment means for rotatably attaching the antenna to the housing at a corner on the second major surface and away from the first major surface so that when the antenna is in the deployed state it is furthest away from the first major surface and it is closest to the first major surface when in the stowed state.

16. The radio communication device of claim **15**, further including a receiver.

17. The radio communication device of claim **16**, further including a second antenna coupled to the receiver.

18. The radio communication device of claim **16**, further including a second antenna coupled to the rotatable antenna for providing the receiver with optimum performance.

* * * * *